MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023

DMA5401 – INTRODUCTION TO PROBABILITY AND STATISTICS

(TC1L & TC2L)

3 JULY 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **5** pages (**3** pages with **4** questions and **2** pages of appendix) excluding cover page. Key formulae are given in the Appendix.

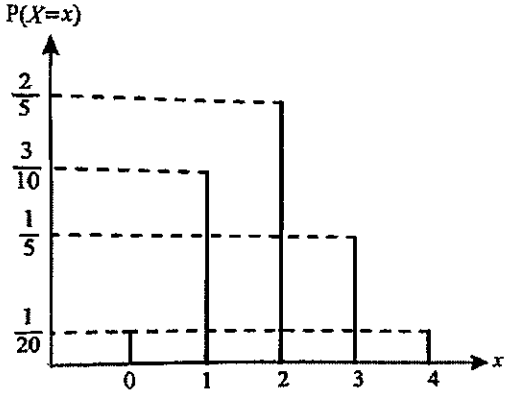
2. Answer ALL questions.

3. Please write all your answers in the Answer Booklet provided.

4. All necessary working steps must be shown.

QUESTION 1 [10 Marks]

a) A researcher conducted a survey on a lifespan of a particular smart watch. It is found that the probability lifespan of the smart watch is less than 2 years is p. A sample of 4 smart watches is selected at random. The diagram below shows the result of the survey where X is distributed binomially and represents the number of smart watches with a lifespan less than 2 years.



i. Show that the value of p is approximate to 0.527. (2.5 marks)

ii. Compute $P(1 < x \leq 3)$. (1 mark)

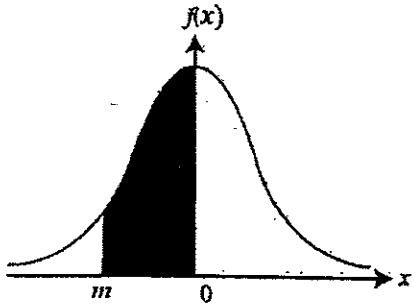
iii. Calculate the expected number of smart watches that are still functioning after 2 years, if 40 smart watches from the same brand are used. (1 mark)

b) On average, there are 8.2 diploma students are barred from graduating due to financial debt on a particular semester. Help the finance team to figure out the

i. probability that at least five diploma students are being barred from graduating on a particular semester. (1.5 marks)

ii. average of diploma students being barred from graduating for two semesters. (1 mark)

c) Diagram below shows a standard normal distribution graph. The probability represented by the area of shaded region is 0.2580.



i. Show that $m = -0.7$. (1 mark)

ii. X is a continuous random variable which is normally distributed with mean, μ and a variance of 25. Find the value of μ if X is 46.5 and the z-score is m. (2 marks)

Continued...

QUESTION 2 [8 Marks]

a) A random sample of 10 students at MMU Cyberjaya were surveyed on the average daily expenditure on their lunch. The sample has a mean of RM15 and a standard deviation of RM6 for the daily lunch expenses. Determine the 95% confidence interval for the corresponding population mean. (3 marks)

b) Unemployment rate in Malaysia showed a significant decrease in the year 2021 compared to the year 2020. In order to test the current situation of unemployment rate in Malaysia, a researcher needs to be 95% confident that the error is at most 0.05. Find the appropriate number of samples for this research. (2 marks)

c) Study shows that university students are reluctant readers. From a survey of 1054 university students, 486 agree to the statement above.
   i. Find the point estimate of the proportion. (1 marks)
   ii. Calculate the margin of error of the estimation made for a 95% confidence level. Round your answer to four decimal places. (2 marks)

QUESTION 3 [12 Marks]

a) Shun SW. et al (2023) revealed that more than half of university students in Selangor suffered from mild to severe depression, anxiety and stress symptom during the pandemic period. *(Source: Shun SW. et al (2023) Depression, anxiety, and stress among university students in Selangor, Malaysia during COVID-19 pandemics and their associated factors, DOI: https://doi.org/10.1371/journal.pone.0280680)*
A counsellor in a private university who disagree with the statement, would like to verify it and selected 110 students randomly. He found that 62 students suffered from mild to severe depression, anxiety and stress symptom during the pandemic period. Given the null and alternative hypothesis, test at 5% level of significance. (3.5 marks)

$$H_0: p \leq 0.5$$
$$H_1: p > 0.5$$

b) Exam Unit Head of a private university claims that students' performance has no different between the online examination and physical examination. A lecturer wanted to test the claim on a specific mathematics subject.

	Online examination	Physical examination
Average score, μ	43	32
Standard deviation, σ	50	50
Number of samples, n	120	110

   i. State the null and alternative hypotheses. (1 mark)
   ii. By using the hypothesis testing of two population means, compute the test statistic, Z. (1.5 marks)
   iii. Test the claim at 10% level of significance. (2 marks)

Continued...

c) A study done in 2022 found that Malaysian spend 550 hours on social media daily. A psychologist claimed that the time spend on social media is lesser. From a sample of 65 Malaysian, he found that the average time spend on social media is 492 hours with a standard deviation of 425 hours. Test the claim at 10% significant level. (4 marks)

QUESTION 4 **[10 Marks]**

a) The table below shows the number of quiz assessments and the score result of students in a Mathematics class.

Number of quiz assessments, x	Score result, y.
5	5.3
7	9.5
8	8.7
2	2.8
5	7.6
7	9.4

i. Calculate $\sum y$ and $\sum y^2$. (2.5 marks)

ii. Refer to part (a) i., show that $SS_{yy} = 35.5083$. (1.5 marks)

iii. Given that the $SS_{xx} = 23.33$ and $SS_{xy} = 26.63$, compute the coefficient of correlation, r. Then, explain your finding. (2 marks)

iv. Predict on a student score if he/she do six quiz assessments and the estimated least square regression equation is $\hat{y} = 1.14x + 0.756$? (1.5 marks)

b) Refer to part (a), the Mathematics teacher claims that there is a positive correlation between the number of quiz assessments done and the score result.

i. State the null and alternative hypotheses. (1 mark)

ii. Given test statistic is $t = 4.87$, determine whether H_0 should be rejected or not at 5% level of significance. (1.5 marks)

Continued...

APPENDIX – KEY FORMULA

BINOMIAL DISTRIBUTION, AND POISSON DISTRIBUTION

- Binomial probability formula: $P(X = x) = \binom{n}{x} p^x q^{n-x}$
- Poisson probability formula: $P(X = x) = \frac{e^{-\lambda}\lambda^x}{x!}$
- Key formula for Binomial Probability Distribution:

If $p \leq 0.5$	If $p > 0.5$
i) $P(X = r) = B(r) - B(r-1)$	i) $P(X = r) = B(n-r) - B(n-r-1)$
ii) $P(X \geq r) = 1 - B(r-1)$	ii) $P(X \geq r) = B(n-r)$
iii) $P(X \leq r) = B(r)$	iii) $P(X \leq r) = 1 - B(n-r-1)$
iv) $P(X > r) = 1 - B(r)$	iv) $P(a \leq X \leq b) = B(n-b) - B(n-a-1)$
v) $P(X < r) = B(r-1)$	
vi) $P(a \leq X \leq b) = B(b) - B(a-1)$	

- Key formula for Poisson Probability Distribution:
  - If $\mu = \lambda$
    - i) $P(X = r) = Poi(r) - Poi(r-1)$
    - ii) $P(X \geq r) = 1 - Poi(r-1)$
    - iii) $P(X \leq r) = Poi(r)$
    - iv) $P(X > r) = 1 - Poi(r)$
    - v) $P(X < r) = Poi(r-1)$
    - vi) $P(a \leq X \leq b) = Poi(b) - Poi(a-1)$

NORMAL AND STANDARD NORMAL PROBABILITY DISTRIBUTION

- z-value (observed value) for an x value: $Z = \frac{x-\mu}{\sigma}$

Continued...

ESTIMATION

- The $(1-\alpha)100\%$ confidence interval for μ is

  $\bar{x} \pm t_{\alpha/2,n-1} s_{\bar{x}}$ where $s_{\bar{x}} = \dfrac{s}{\sqrt{n}}$

- The $(1-\alpha)100\%$ confidence interval for p is

  $\hat{p} \pm z_{\alpha/2} s_{\hat{p}}$ where $s_{\hat{p}} = \sqrt{\dfrac{\hat{p}\hat{q}}{n}}$

- **Sample size**

$$n = \left[\frac{\left(Z_{\alpha/2}\right)\sigma}{E} \right]^2$$

HYPOTHESIS TESTING

- **ONE population**

  Mean:
  $$Z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$

  Proportion:
  $$Z = \frac{\hat{p} - p}{\sqrt{\dfrac{pq}{n}}}$$

- **TWO population**

  Mean:
  $$Z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\dfrac{\sigma_1^2}{n_1} + \dfrac{\sigma_2^2}{n_2}}}$$

REGRESSION & CORRELATION

- **Correlation coefficient, r**

$$r = \frac{SS_{xy}}{\sqrt{SS_{xx} SS_{yy}}} \quad \text{where} \quad SS_{xx} = \sum x^2 - \frac{\left(\sum x\right)^2}{n},$$

$$SS_{yy} = \sum y^2 - \frac{\left(\sum y\right)^2}{n}, \text{and} \quad SS_{xy} = \sum xy - \frac{\left(\sum x\right)\left(\sum y\right)}{n}$$

- **Correlation t-Test**

$$t = \frac{r}{\sqrt{\dfrac{1-r^2}{n-2}}}$$

End of Page.